Moving in a Lonely Universe

Mike Stannett

Department of Computer Science, University of Sheffield
Regent Court, 211 Portobello, Sheffield S1 4DP, UK
m.stannett@dcs.shef.ac.uk

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Abstract

Consider a Universe containing only a single pointlike self-observing particle. Given the lack of other entities relative to which its position and velocity can be assessed, what, if anything, does it mean to say that this particle occupies a particular location in spacetime, or that it is capable of motion? We consider this and related questions, and ask whether the particle's self-observations can consistently generate the appearance of a richly populated Universe governed by mathematical laws of motion, like the one we see around us.